**3.4 – Predicting Products of Reactions**

* Now that we have a solid basis of knowledge of chemical reactions, we can begin to predict the products on our own.
* There are a few patterns to watch for…

Combustion

* Combustion reactions are generally pretty easy to spot.
* As a review, note that these reactions have \_\_\_\_\_\_\_\_\_\_\_\_ as a reactant, with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_ as products.
* Usually, the other reactant is something \_\_\_\_\_\_\_\_\_\_\_\_ (a hydrocarbon, glucose, etc.)
* For example, predict:
  + C2H6 + O2 🡪

Becomes….

* + C2H6 + O2 🡪

The rest is just balancing…

* + \_\_\_ C2H6 + \_\_\_ O2 🡪

Synthesis

* Synthesis reactions can be a bit more complicated.
* Remember that synthesis is generally of the formula \_\_\_\_\_\_\_\_\_\_\_\_.
* Many synthesis reactions are simple. For example:
  + H2 + O2 🡪

Becomes…

* \_\_\_ H2 + O2 🡪
* However, there are a few odd synthesis rules that must be followed:
  + Non-metal oxide + water 🡪 ACID (H\_\_\_)
    - Ex.
  + Metal oxide + water 🡪 BASE (Metal OH)
    - Ex.
  + Metal chloride + oxygen 🡪 Metal ClO3
    - Ex.
  + Metal oxide + carbon dioxide 🡪 Metal CO3
    - Ex.

Decomposition

* This reaction is easy to identify, since there is only ever \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* There will always be more than one product. Remember the formula \_\_\_\_\_\_\_\_\_\_\_\_.
* For example, predict:
  + Ag2O 🡪

Becomes…

* + \_\_\_ Ag2O 🡪
* Since decomposition is the \_\_\_\_\_\_\_\_\_\_\_\_ of synthesis, it is important to note that you could see the synthesis rules applying here as well.
* They would, however, be happening \_\_\_\_\_\_\_\_\_\_\_\_.
* For example:
  + H2CO3 🡪

Becomes…

* + H2CO3 🡪

Single Displacement

* These reactions can be identified when one of the reactant molecules has only \_\_\_\_\_\_\_\_ type of atom, and the other has \_\_\_\_\_\_\_. Remember the formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* However, there is another set of rules here to follow known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Activity Series

* The activity series is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of metals and halogens referring to their \_\_\_\_\_\_\_\_\_\_\_\_.
* This determines whether or not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reactions will occur.
* Refer to your activity series handout, and consider the following:
  + A single replacement reaction \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if the reactivity of the pure element reactant is **\_\_\_\_\_\_\_\_** than that of the compound reactant.
    - i.e. Sn + NaNO3 🡪 no reaction, because tin is less reactive than sodium.
  + A single replacement reaction \_\_\_\_\_\_\_\_\_\_\_\_ if the reactivity of the pure element reactant is \_\_\_\_\_\_\_\_\_\_\_\_ than that of the compound reactant.
    - i.e. Zn + H2SO4 🡪 ZnSO4 + H2

Double Displacement

* This reaction occurs between two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It involves the exchange of cations.
* Remember the formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* For example, predict:
  + AgNO3 + NaCl 🡪

Becomes…

* + AgNO3 + NaCl 🡪

Acid-Base

* This is simply a special type of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reaction. The format of the reaction is the same, but this is characterized by the formation of \_\_\_\_\_\_\_\_\_\_\_\_ and some type of \_\_\_\_\_\_\_\_\_\_\_\_ as products.
* Tip: When identifying acid-base reactions, watch for the \_\_\_\_\_\_ in one of the reactant and an \_\_\_\_\_\_\_\_\_ in the other reactant. These two combine to make \_\_\_\_\_\_\_\_ (H2O).
* For example, predict:
  + H3PO4 + Mg(OH)2 🡪

Becomes…

* + \_\_\_ H3PO4 + \_\_\_ Mg(OH)2 🡪